Infineon Technologies - XMC1402F064X0200AAXUMA1 Datasheet

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M0
Core Size	32-Bit Single-Core
Speed	48MHz
Connectivity	I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, I²S, POR, PWM, WDT
Number of I/O	48
Program Memory Size	200KB (200K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	16K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 12x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	PG-LQFP-64
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/xmc1402f064x0200aaxuma1

XMC1400 AA-Step

Microcontroller Series
for Industrial Applications

XMC1000 Family

ARM® Cortex®-M0
32-bit processor core

Data Sheet

V1.3 2016-10

Microcontrollers

Table of Contents

About this Document

This Data Sheet is addressed to embedded hardware and software developers. It provides the reader with detailed descriptions about the ordering designations, available features, electrical and physical characteristics of the XMC1400 series devices.

The document describes the characteristics of a superset of the XMC1400 series devices. For simplicity, the various device types are referred to by the collective term XMC1400 throughout this document.

XMC1000 Family User Documentation

The set of user documentation includes:

- **Reference Manual**
  – decribes the functionality of the superset of devices.
- **Data Sheets**
  – list the complete ordering designations, available features and electrical characteristics of derivative devices.
- **Errata Sheets**
  – list deviations from the specifications given in the related Reference Manual or Data Sheets. Errata Sheets are provided for the superset of devices.

Attention: Please consult all parts of the documentation set to attain consolidated knowledge about your device.

Application related guidance is provided by **Users Guides** and **Application Notes**.

Please refer to **http://www.infineon.com/xmc1000** to get access to the latest versions of those documents.

1 Summary of Features

The XMC1400 devices are members of the XMC1000 Family of microcontrollers based on the ARM Cortex-M0 processor core. The XMC1400 series addresses the real-time control needs of motor control and digital power conversion. It also features peripherals for LED Lighting applications and Human-Machine Interface (HMI).

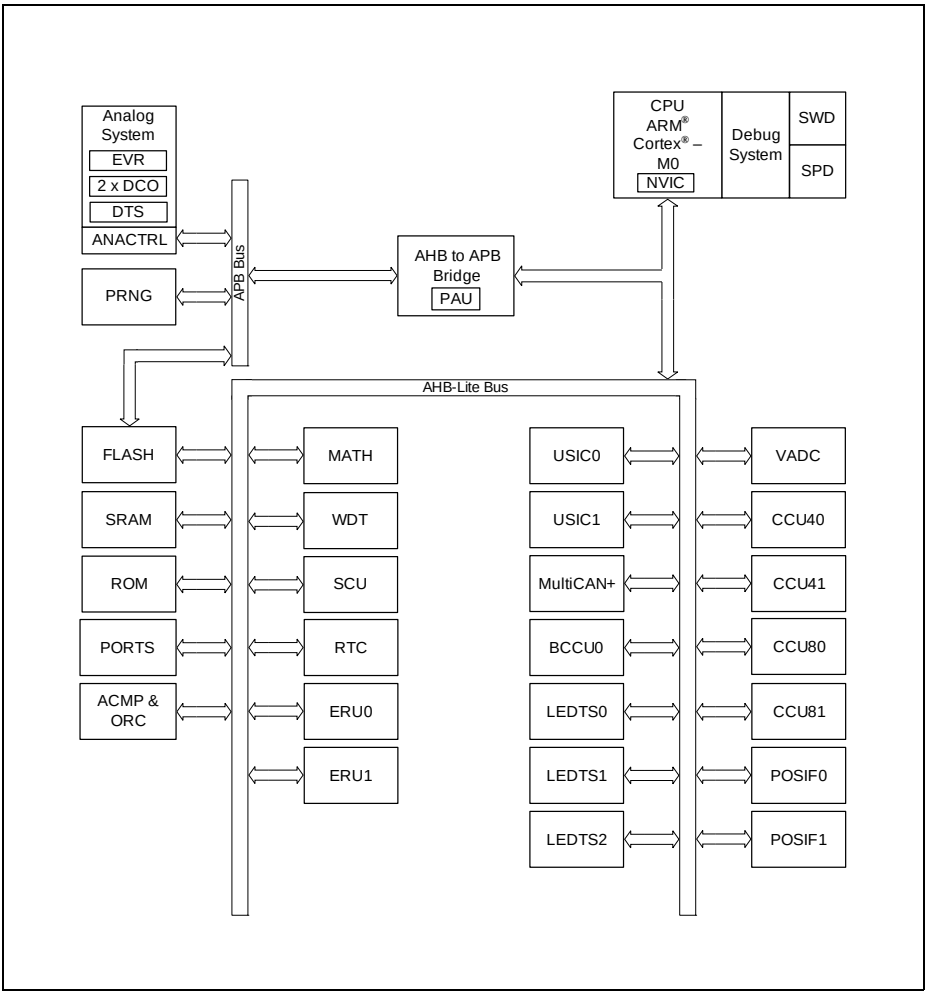


Figure 1 Block Diagram

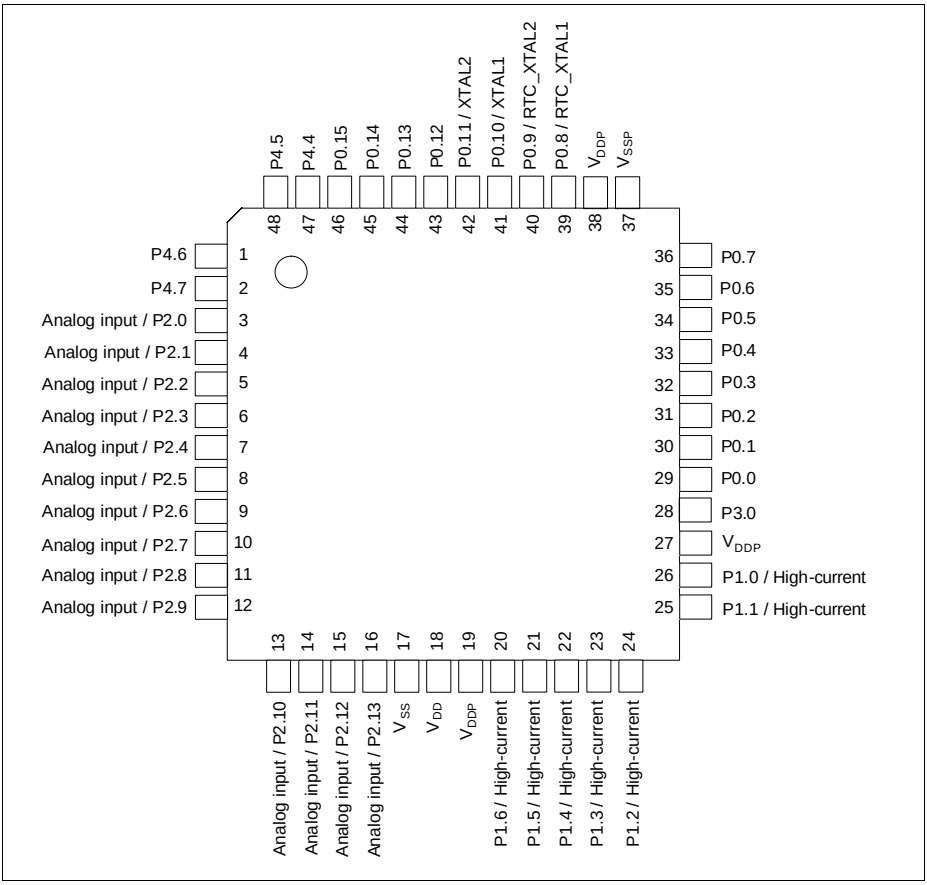


Figure 8 XMC1400 PG-VQFN-48-73 Pin Configuration (top view)

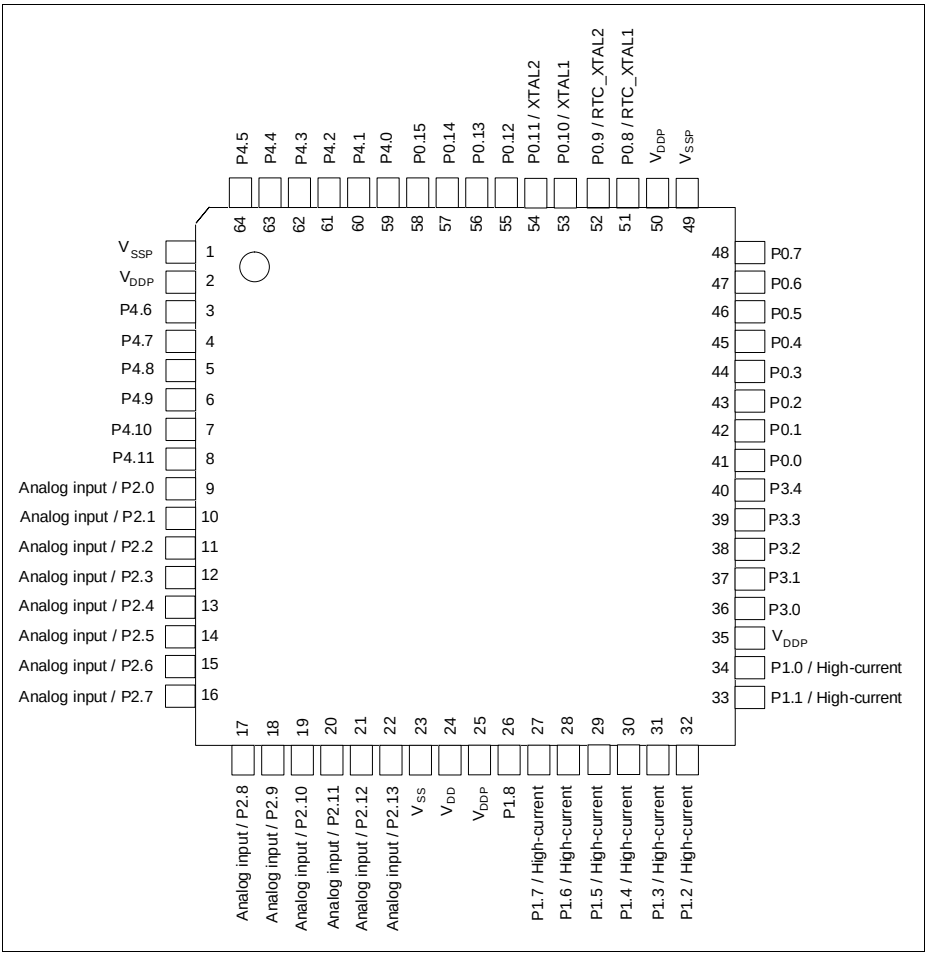


Figure 9 XMC1400 PG-LQFP-64-26 / PG-VQFN-64-6 Pin Configuration (top view)

Table 5 Package Pin Mapping (cont'd)

Function	LQFP 64, VQFN 64	VQFN 48	VQFN 40	TSSOP 38	Pad Type	Notes
P0.9/ RTC_ XTAL2	52	40	34	28	STD_INOUT /clock_O	
P0.10/ XTAL1	53	41	35	29	STD_INOUT /clock_IN	
P0.11/ XTAL2	54	42	36	30	STD_INOUT /clock_O	
P0.12	55	43	37	31	STD_INOUT	
P0.13	56	44	38	32	STD_INOUT	
P0.14	57	45	39	33	STD_INOUT	
P0.15	58	46	40	34	STD_INOUT	
P1.0	34	26	22	16	High Current	
P1.1	33	25	21	15	High Current	
P1.2	32	24	20	14	High Current	
P1.3	31	23	19	13	High Current	
P1.4	30	22	18	12	High Current	
P1.5	29	21	17	11	High Current	
P1.6	28	20	16	-	High Current	
P1.7	27	-	-	-	High Current	
P1.8	26	-	-	-	STD_INOUT	
P2.0	9	3	1	35	STD_INOUT /AN	
P2.1	10	4	2	36	STD_INOUT /AN	
P2.2	11	5	3	37	STD_IN/AN	
P2.3	12	6	4	38	STD_IN/AN	
P2.4	13	7	5	1	STD_IN/AN	
P2.5	14	8	6	2	STD_IN/AN	
P2.6	15	9	7	3	STD_IN/AN	
P2.7	16	10	8	4	STD_IN/AN	

Table 5 Package Pin Mapping (cont'd)

Function	LQFP 64, VQFN 64	VQFN 48	VQFN 40	TSSOP 38	Pad Type	Notes
P2.8	17	11	9	5	STD_IN/AN	
P2.9	18	12	10	6	STD_IN/AN	
P2.10	19	13	11	7	STD_INOUT /AN	
P2.11	20	14	12	8	STD_INOUT /AN	
P2.12	21	15	-	-	STD_INOUT /AN	
P2.13	22	16	-	-	STD_INOUT /AN	
P3.0	36	28	-	-	STD_INOUT	
P3.1	37	-	-	-	STD_INOUT	
P3.2	38	-	-	-	STD_INOUT	
P3.3	39	-	-	-	STD_INOUT	
P3.4	40	-	-	-	STD_INOUT	
P4.0	59	-	-	-	STD_INOUT	
P4.1	60	-	-	-	STD_INOUT	
P4.2	61	-	-	-	STD_INOUT	
P4.3	62	-	-	-	STD_INOUT	
P4.4	63	47	-	-	STD_INOUT	
P4.5	64	48	-	-	STD_INOUT	
P4.6	3	1	-	-	STD_INOUT	
P4.7	4	2	-	-	STD_INOUT	
P4.8	5	-	-	-	STD_INOUT	
P4.9	6	-	-	-	STD_INOUT	
P4.10	7	-	-	-	STD_INOUT	
P4.11	8	-	-	-	STD_INOUT	
VSS	23	17	13	9	Power	Supply GND, ADC reference GND

2.2.3 Port I/O Function Description

The following general building block is used to describe the I/O functions of each PORT pin:

Table 7 Port I/O Function Description

Function	Outputs		Inputs	
	ALT1	ALTn	Input	Input
P0.0		MODA.OUT	MODC.INA	
Pn.y	MODA.OUT		MODA.INA	MODC.INB

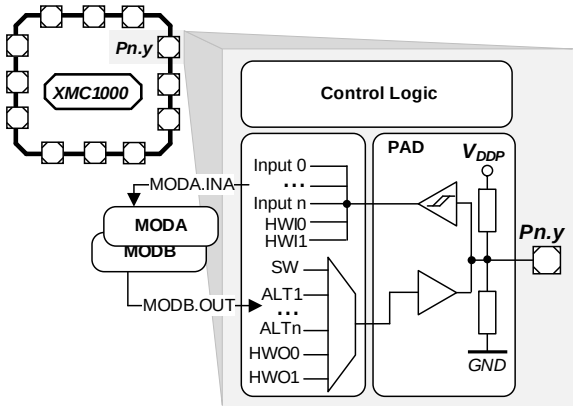


Figure 10 Simplified Port Structure

Pn.y is the port pin name, defining the control and data bits/registers associated with it. As GPIO, the port is under software control. Its input value is read via Pn_IN.y, Pn_OUT defines the output value.

Up to nine alternate output functions (ALT1 to ALT9) can be mapped to a single port pin, selected by Pn_IOCR.PC. The output value is directly driven by the respective module, with the pin characteristics controlled by the port registers (within the limits of the connected pad).

The port pin input can be connected to multiple peripherals. Most peripherals have an input multiplexer to select between different possible input sources.

The input path is also active while the pin is configured as output. This allows to feedback an output to on-chip resources without wasting an additional external pin.

Please refer to the **Port I/O Functions** table for the complete Port I/O function mapping.

Table 9 Port I/O Functions (cont'd)

Function	Outputs									Inputs											
	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6	ALT7	ALT8	ALT9	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input
P2.2										ACMP2.INN	VADC0.G0CH7		ORC0.AIN	USIC1_CH0.DX5E		USIC0_CH0.DX3A	USIC0_CH0.DX4A	USIC0_CH1.DX5A			ERU0.0B1
P2.3												VADC0.G1CH5	ORC1.AIN	USIC1_CH0.DX3E	USIC1_CH0.DX4E	USIC1_CH1.DX5C	USIC0_CH0.DX5B	USIC0_CH1.DX3C	USIC0_CH1.DX4C		ERU0.1B1
P2.4												VADC0.G1CH6	ORC2.AIN	USIC1_CH1.DX3C	USIC1_CH1.DX4C	USIC0_CH0.DX3B	USIC0_CH0.DX4B	USIC1_CH0.DX5F	USIC0_CH1.DX5B		ERU0.0A1
P2.5												VADC0.G1CH7	ORC3.AIN	USIC1_CH1.DX5D		USIC0_CH0.DX5D		USIC0_CH1.DX3E	USIC0_CH1.DX4E		ERU0.1A1
P2.6										ACMP1.INN	VADC0.G0CH0		ORC4.AIN	USIC1_CH1.DX3E	USIC1_CH1.DX4E	USIC0_CH0.DX3E	USIC0_CH0.DX4E	USIC0_CH1.DX5D			ERU0.2A1
P2.7										ACMP1.INP		VADC0.G1CH1	ORC5.AIN	USIC1_CH1.DX5E		USIC0_CH0.DX5C		USIC0_CH1.DX3D	USIC0_CH1.DX4D		ERU0.3A1
P2.8										ACMP0.INN	VADC0.G0CH1	VADC0.G1CH0	ORC6.AIN			USIC0_CH0.DX3D	USIC0_CH0.DX4D	USIC0_CH1.DX5C			ERU0.3B1
P2.9										ACMP0.INP	VADC0.G0CH2	VADC0.G1CH4	ORC7.AIN			USIC0_CH0.DX5A		USIC0_CH1.DX3B	USIC0_CH1.DX4B		ERU0.3B0
P2.10	ERU0.PDOUT1	CCU40.OUT2	ERU0.GOUT1	LEDTS1.COL4	CCU80.OUT30	ACMP0.OUT	USIC0_CH1.DOUT0		CAN.N1_TXD		VADC0.G0CH3	VADC0.G1CH2				USIC0_CH0.DX3C	USIC0_CH0.DX4C	USIC0_CH1.DX0F		CAN.N1_RXDE	ERU0.2B0
P2.11	ERU0.PDOUT0	CCU40.OUT3	ERU0.GOUT0	LEDTS1.COL3	CCU80.OUT31	USIC0_CH1.SCLKOUT	USIC0_CH1.DOUT0		CAN.N1_TXD	ACMP.REF	VADC0.G0CH4	VADC0.G1CH3						USIC0_CH1.DX0E	USIC0_CH1.DX1E	CAN.N1_RXDF	ERU0.2B1
P2.12	BCCU0.OUT3	VADC0.EMUX00	USIC1_CH0.SCLKOUT	USIC1_CH1.SCLKOUT		ACMP2.OUT	USIC1_CH1.DOUT0	LEDTS2.COL6		ACMP3.INN						USIC1_CH0.DX3A	USIC1_CH0.DX4A	USIC1_CH1.DX0C	USIC1_CH1.DX1B		ERU1.3A2
P2.13	BCCU0.OUT4	CCU40.OUT3	USIC1_CH0.MCLKOUT	CCU81.OUT31		VADC0.EMUX01	USIC1_CH1.DOUT0	CCU81.OUT33	CCU41.OUT3	ACMP3.INP						USIC1_CH0.DX5A		USIC1_CH1.DX0D			ERU1.3A3
P3.0	BCCU0.OUT0	USIC1_CH1.DOUT0	USIC1_CH1.SCLKOUT	LEDTS2.COLA	CCU80.OUT21	ACMP1.OUT	USIC1_CH0.SELO1	CCU81.OUT21	CCU41.OUT0	BCCU0.TRAPINC	CCU41.IN0AA	CCU41.IN1AA	CCU41.IN2AA	CCU41.IN3AA	CCU81.IN0AA	CCU81.IN1AA	CCU81.IN2AA	USIC1_CH1.DX0E	USIC1_CH1.DX1D	CCU81.IN3AA	ERU1.0A1
P3.1	BCCU0.OUT1	USIC1_CH1.DOUT0		LEDTS2.COL0	CCU80.OUT20	ACMP3.OUT	USIC1_CH0.SELO0	CCU81.OUT20	CCU41.OUT1								USIC1_CH0.DX2F	USIC1_CH1.DX0F			ERU1.1A1

Table 10 Hardware I/O Controlled Functions

Function	Outputs	Outputs	Inputs	Inputs	Pull Control	Pull Control	Pull Control	Pull Control
	HWO0	HWO1	HWI0	HWI1	HW0_PD	HW0_PU	HW1_PD	HW1_PU
P4.4	LEDTS2. EXTENDED0		LEDTS2.TSIN0	LEDTS2.TSIN0	Reserved for LEDTS Scheme A: pull-down disabled always	Reserved for LEDTS Scheme A: pull-down enabled always	Reserved for LEDTS Scheme B: pull-up enabled and pull-down disabled, and vice versa	
P4.5	LEDTS2. EXTENDED1		LEDTS2.TSIN1	LEDTS2.TSIN1				
P4.6	LEDTS2. EXTENDED2		LEDTS2.TSIN2	LEDTS2.TSIN2				
P4.7	LEDTS2. EXTENDED3		LEDTS2.TSIN3	LEDTS2.TSIN3				
P4.8	LEDTS2. EXTENDED4		LEDTS2.TSIN4	LEDTS2.TSIN4				
P4.9	LEDTS2. EXTENDED5		LEDTS2.TSIN5	LEDTS2.TSIN5				
P4.10	LEDTS2. EXTENDED6		LEDTS2.TSIN6	LEDTS2.TSIN6				
P4.11	LEDTS2. EXTENDED7		LEDTS2.TSIN7	LEDTS2.TSIN7				

3 Electrical Parameter

This section provides the electrical parameter which are implementation-specific for the XMC1400.

3.1 General Parameters

3.1.1 Parameter Interpretation

The parameters listed in this section represent partly the characteristics of the XMC1400 and partly its requirements on the system. To aid interpreting the parameters easily when evaluating them for a design, they are indicated by the abbreviations in the “Symbol” column:

- **CC**
  Such parameters indicate **C**ontroller **C**haracteristics, which are distinctive feature of the XMC1400 and must be regarded for a system design.
- **SR**
  Such parameters indicate **S**ystem **R**equirements, which must be provided by the application system in which the XMC1400 is designed in.

3.1.4 Operating Conditions

The following operating conditions must not be exceeded in order to ensure correct operation and reliability of the XMC1400. All parameters specified in the following tables refer to these operating conditions, unless noted otherwise.

Table 15 Operating Conditions Parameters

Parameter	Symbol		Values			Unit	Note / Test Condition
			Min.	Typ.	Max.		
Ambient Temperature	T_A	SR	-40	–	85	°C	Temp. Range F
			-40	–	105	°C	Temp. Range X
Digital supply voltage[1)]	V_{DDP}	SR	1.8	–	5.5	V	
Short circuit current of digital outputs	I_{SC}	SR	-5	–	5	mA	
Absolute sum of short circuit currents of the device	ΣI_{SC_D}	SR	–	–	25	mA	

1) See also the Supply Monitoring thresholds, **Chapter 3.3.2**.

Table 22 RTC_XTAL Parameters

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input frequency	f_{OSC} SR	–	32.768	–	kHz	
Oscillator start-up time[1)2)]	t_{OSCS} CC	–	–	5	s	
Input voltage at RTC_XTAL1	V_{IX} SR	-0.3	–	1.5	V	
Input amplitude (peak-to-peak) at RTC_XTAL1[2)3)]	V_{PPX} SR	0.2	–	1.2	V	

1) t_{OSCS} is defined from the moment the oscillator is enabled by the user with SCU_ANAOSCLPCTRL.MODE until the oscillations reach an amplitude at RTC_XTAL1 of 0.9 * V_{PPX}.

2) The external oscillator circuitry must be optimized by the customer and checked for negative resistance and amplitude as recommended and specified by crystal suppliers.

3) If the shaper unit is enabled and not bypassed.

3.2.7 Power Supply Current

The total power supply current defined below consists of a leakage and a switching component.

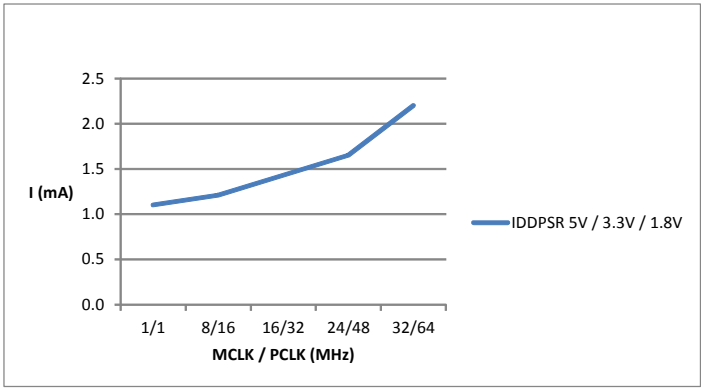
Application relevant values are typically lower than those given in the following tables, and depend on the customer's system operating conditions (e.g. thermal connection or used application configurations).

Note: These parameters are not subject to production test, but verified by design and/or characterization.

Table 23 Power Supply parameter table; V_{DDP} = 5V

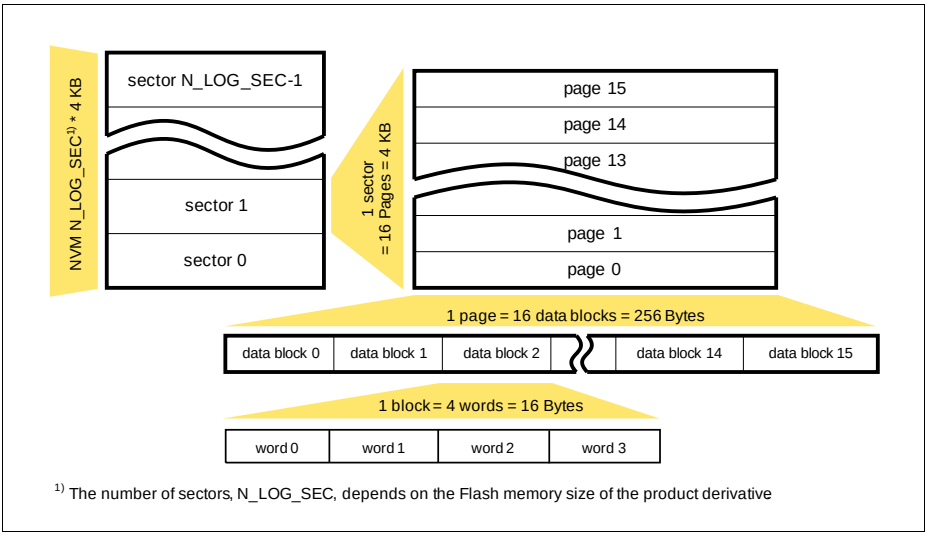
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.[1]	Max.		
Active mode current Peripherals enabled f_{MCLK} / f_{PCLK} in MHz[2]	I_{DDPAE} CC	–	14.1	20	mA	48 / 96
		–	9.8	–	mA	24 / 48
		–	7.8	–	mA	16 / 32
		–	6.4	–	mA	8 / 16
		–	4.4	–	mA	1 / 1
Active mode current Peripherals disabled f_{MCLK} / f_{PCLK} in MHz[3]	I_{DDPAD} CC	–	6.2		mA	48 / 96
		–	4.6	–	mA	24 / 48
		–	3.6	–	mA	16 / 32
		–	3.1	–	mA	8 / 16
		–	1.8	–	mA	1 / 1
Active mode current Code execution from RAM Flash is powered down f_{MCLK} / f_{PCLK} in MHz	I_{DDPAR} CC	–	9.6	–	mA	48 / 96
Sleep mode current Peripherals clock enabled f_{MCLK} / f_{PCLK} in MHz[4]	I_{DDPSE} CC	–	11.0	–	mA	48 / 96
		–	7.6	–	mA	24 / 48
		–	6.4	–	mA	16 / 32
		–	5.3	–	mA	8 / 16
		–	4.2	–	mA	1 / 1

Figure 18 shows typical graphs for sleep mode current for V_{DDP} = 5 V, V_{DDP} = 3.3 V, V_{DDP} = 1.8 V across different clock frequencies.



Condition:
1. TA = +25° C

Figure 18 Sleep mode, peripherals clocks disabled, Flash powered down: Supply current I_{DDPSD} over supply voltage V_{DDP} for different clock frequencies



[1] The number of sectors, N_LOG_SEC, depends on the Flash memory size of the product derivative

Figure 19 Logical Structure of the Flash

Table 32 USIC SSC Slave Mode Timing

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Select input DX2 hold after last clock input DX1 receive edge[1]	t_{11} SR	17	–	–	ns	
Receive data input DX0/DX[5:3] setup time to shift clock receive edge[1]	t_{12} SR	21	–	–	ns	
Data input DX0/DX[5:3] hold time from clock input DX1 receive edge[1]	t_{13} SR	15	–	–	ns	
Data output DOUT[3:0] valid time	t_{14} CC	-	–	71	ns	

1) These input timings are valid for asynchronous input signal handling of slave select input, shift clock input, and receive data input (bits DXnCR.DSEN = 0).

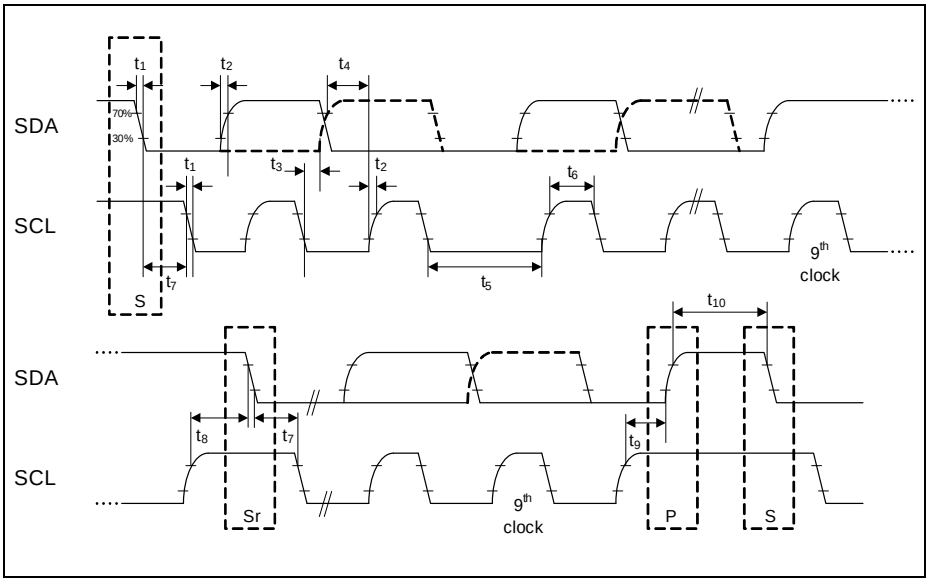


Figure 26 USIC IIC Timing

3.3.6.3 Inter-IC Sound (IIS) Interface Timing

The following parameters are applicable for a USIC channel operated in IIS mode.

Note: Operating Conditions apply.

Table 35 USIC IIS Master Transmitter Timing

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clock period	t_1 CC	$4/f_{MCLK}$	-	-	ns	
Clock HIGH	t_2 CC	0.35 x t_{1min}	-	-	ns	
Clock Low	t_3 CC	0.35 x t_{1min}	-	-	ns	
Hold time	t_4 CC	0	-	-	ns	
Clock rise time	t_5 CC	-	-	0.15 x t_{1min}	ns	

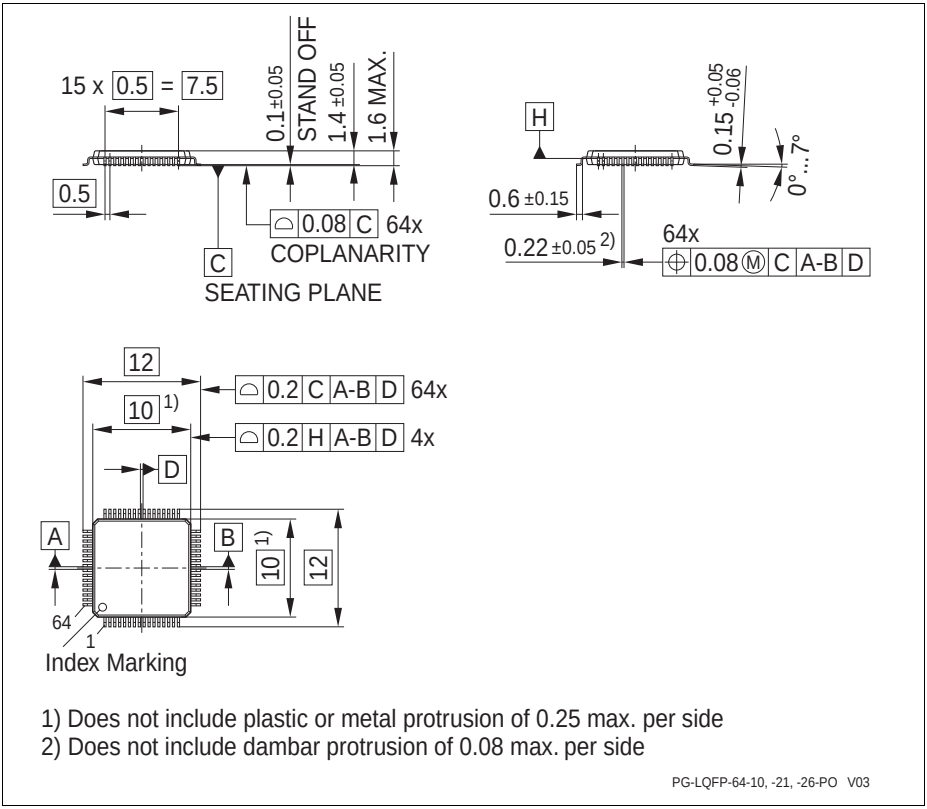


Figure 32 PG-LQFP-64-26